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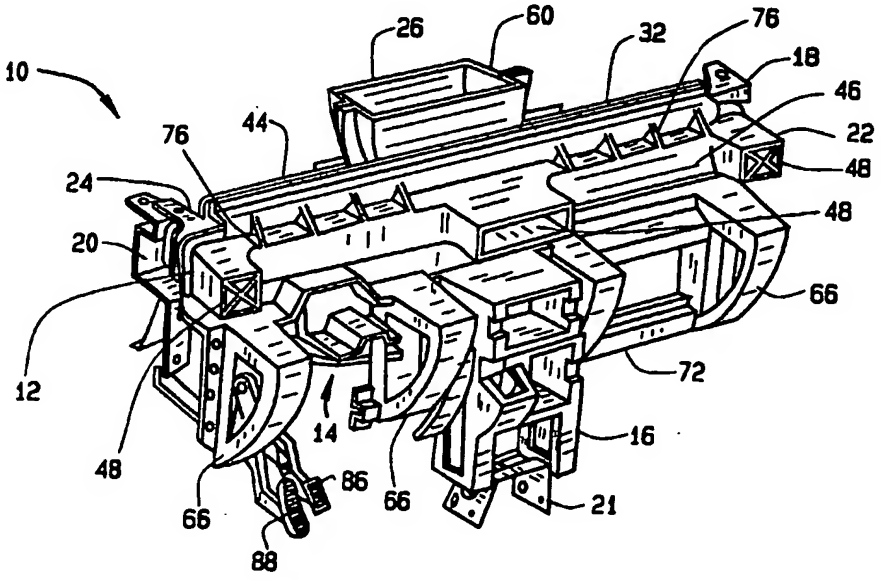
(54) Title: INSTRUMENT PANEL BEAM ASSEMBLY AND METHODS OF MANUFACTURE



(57) Abstract: An instrument panel beam assembly (10) includes, in an exemplary embodiment, an elongate front beam member (22) having a plurality of duct channels (28, 32) and a plurality of energy absorbers (66). The beam assembly also includes an elongate rear beam member (24) having a plurality of duct channels (36, 38, 40) corresponding to the front beam member duct channels. The front beam member is couple to the rear beam member forming a beam structure (12) so that the plurality of corresponding duct channels in the front and rear beam members form a plurality of ducts (42, 44, 46) in the beam structure.

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INSTRUMENT PANEL BEAM ASSEMBLY AND METHODS OF MANUFACTURE

BACKGROUND OF THE INVENTION

[0001] Known instrument panel assemblies include a beam structure and at least one decorative instrument panel attached to the beam structure. Some of the decorative panels act as knee bolsters to protect the knees of vehicle occupants in the event of an impact. An instrument panel assembly is mounted inside the passenger compartment of an automobile with the beam structure attached to the automobile body, typically to the A-pillar. Known instrument panel beam structures are fabricated from steel, aluminum, magnesium, or plastic.

[0002] A number of vehicle systems are housed within an instrument panel, for example, the heating, ventilating, and air conditioning (HVAC) system. The HVAC system includes a number of air distribution ducts housed within the instrument panel. In known instrument panels the HVAC ducts are separate components attached to the instrument panel beam structure. Multiple components increases complexity of the assembly which increases fabrication time and increases labor costs.

[0003] U.S. Patent 5,312,133 describes an instrument panel assembly that includes a steel beam and a duct system attached to the steel beam that does not deform and absorb energy. The duct system includes a front channel member and a rear channel member bonded together with adhesive to form the duct system.

[0004] U.S. Patent 5,549,344 describes an instrument panel assembly that includes a metal support beam, a plastic base member, and a plurality of ducts. The ducts are separately formed and then hot plate heat welded to the base member to form an integral unit. The base member and ducts are then attached to the metal support beam.

[0005] U.S. Patent 5,676,216 describes an instrument panel assembly that includes a knee bolster assembly, an instrument panel, a reinforcement assembly, a beam duct assembly, and a fastening assembly. The beam assembly has a two piece beam structure that includes an integrated air distribution system. Each piece of the beam structure is formed from sheet molding compound (SMC) and are bonded together with adhesive. The reinforcement assembly includes separate metal reinforcement members to support the knee bolsters of the instrument panel.

[0006] U.S. Patent 5,762,395 describes a instrument panel assembly that includes a one piece plastic cross car support structure that has a plurality of laterally extending, upwardly opening U-shaped duct channels. The assembly also includes an instrument panel that is continuously secured to upward facing edges of the U-shaped duct channels to form closed ducts in the assembly.

BRIEF DESCRIPTION OF THE INVENTION

[0007] In one aspect, an instrument panel beam assembly is provided that includes an elongate front beam member having a plurality of duct channels and a plurality of energy absorbers. The beam assembly also includes an elongate rear beam member having a plurality of duct channels corresponding to the front beam member duct channels. The front beam member is coupled to the rear beam member forming a beam structure so that the plurality of corresponding duct channels in the front and rear beam members form a plurality of ducts in the beam structure.

[0008] In another aspect, a method of producing an instrument panel beam assembly includes molding from a thermoplastic material, an elongate front beam member that includes a plurality of duct channels and a plurality of energy absorbers. The method also includes molding form a thermoplastic material, an elongate rear beam member that includes a plurality of duct channels corresponding to the front beam member duct channels. The method further includes coupling the front beam member to the rear beam member forming a beam structure so that the plurality of corresponding duct channels in the front and rear beam members form a plurality of ducts in the beam structure.

[0009] In another aspect, an instrument panel beam assembly is provided that includes a thermoplastic front beam member having a plurality of molded-in duct channels and a plurality of energy absorbers. The beam assembly also includes a thermoplastic rear beam member having a plurality of molded-in duct channels corresponding to the front beam member duct channels. The front beam member is coupled to the rear beam member forming a beam structure with the plurality of corresponding duct channels in the front and rear beam members forming a plurality of ducts in the beam structure. The beam assembly further includes a thermoplastic defrost plenum member having at least one defrost duct channel corresponding to and aligning with at least one defrost duct channel in the rear beam member so that the defrost duct channels of the plenum member and the rear beam member form at least one defrost duct when the plenum member is coupled to the rear beam member.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] Figure 1 is a perspective view of an instrument panel beam assembly in accordance with an embodiment of the present invention.

[0011] Figure 2 is an exploded perspective front view of the instrument panel beam assembly shown in Figure 1.

[0012] Figure 3 is an exploded perspective rear view of the instrument panel beam assembly shown in Figure 1.

DETAILED DESCRIPTION OF THE INVENTION

[0013] An instrument panel beam assembly that includes a thermoplastic beam structure having integrally molded-in HVAC ducts and energy absorbers is described below in detail. The thermoplastic beam structure supports the decorative panel(s) of the instrument panel. The integrally molded-in HVAC ducts and energy absorbers result in fewer parts than known instrument panel structures which provides for simplified instrument panel fabrication and lower fabrication labor costs.

[0014] The thermoplastic beam structure can be molded from one of many thermoplastic materials. Suitable thermoplastic materials include, but are not limited to, acrylonitrile-butadiene-styrene (ABS), polycarbonate, polycarbonate/ABS blend, a copolycarbonate-polyester, acrylic-styrene-acrylonitrile (ASA), acrylonitrile-(ethylene-polypropylene diamine modified)-styrene (AES), phenylene ether resins, glass filled blends of polyphenylene oxide and polystyrene, blends of polyphenylene ether/polyamide (NORYL GTX® from General Electric Company), blends of polycarbonate/PET/PBT, polybutylene terephthalate and impact modifier (XENOY® resin from General Electric Company), polyamides, phenylene sulfide resins, polyvinyl chloride PVC, high impact polystyrene (HIPS), low/high density polyethylene, polypropylene and thermoplastic olefins (TPO).

[0015] Referring to the drawings, Figure 1 is a perspective view of an instrument panel beam assembly 10 in accordance with an exemplary embodiment of the present invention, and Figures 2 and 3 are exploded perspective front and rear views of beam assembly 10 respectively. Instrument panel beam assembly 10 includes a molded thermoplastic beam structure 12, with a steering column support 14, a center stack 16 and end brackets 18 and 20 attached to beam structure 12. A floor bracket 21 couples center stack 16 to a floor pan (not shown) of an automobile.

[0016] Beam structure 12 is formed by a front beam member 22, a rear beam member 24, and a defrost plenum member 26. Front beam member 22 includes molded-in HVAC duct channels, specifically, side window defrost duct channel 28 and main air conditioning duct channel 32. Rear beam member 24 includes corresponding HVAC duct channels molded into a first side 34 of rear beam member 24. Specifically, side window defrost duct channels 36 and 38, and main air conditioning duct channel 40 are molded into first side 34 of rear beam member 24. Front and rear beam members are coupled together with corresponding side window defrost duct channels 28, 36, and 38 forming side window defrost ducts 42 and 44, and main air conditioning duct channels 32 and 40 forming a main air conditioning duct 46. Front beam member 22 also includes a plurality of air conditioning duct outlets 48.

[0017] A second side 50 of rear beam member 24 includes a molded-in front window defrost duct channel 52. Defrost plenum 26 includes corresponding molded-in duct channels, specifically, a front window defrost duct channel 54 and side window defrost duct connection channels 56 and 58. Rear beam member 24 and defrost plenum 26 are coupled together with corresponding front window defrost duct channels 52 and 54 forming a front window defrost duct 60, and side window defrost duct connection channels 56 and 58 connecting to side window defrost ducts 42 and 44.

[0018] Front beam member 22 and rear beam member 24, in one exemplary embodiment, are coupled by vibration welding, and in alternate embodiments by at least one of heat bonding, adhesive bonding, and fasteners. Also, rear beam member 24 and defrost plenum 26, in one exemplary embodiment, are coupled by vibration welding, and in alternate embodiments by at least one of heat bonding, adhesive bonding, and fasteners.

[0019] A plurality of energy absorbers 66 extend from a bottom side edge 68 of front beam member 22. Energy absorbers 66 and a main body portion 70 of front beam member 22 are molded as one piece. Knee bolsters (not shown) are part of an instrument panel and are supported by energy absorbers 66. During an impact situation, energy is transferred from a passenger knee to a knee bolster and to energy absorbers 66. The deformation of energy absorbers 66 dissipates the energy and prevents injury to the passenger knee. In the exemplary embodiment, energy absorbers 66 have a substantially D-shape configuration. In alternate embodiments, energy absorbers 66 can have any suitable shape that is capable of deforming from the force of a vehicle occupant's knee against the knee bolster in an impact event, and thereby absorbing energy from the occupant's knee. A C-channel support rod 72 extends between energy absorbers 66. C-channel support rod 72 includes a glove box hinge 74.

[0020] A plurality of stiffening ribs 76 extend from an outer surface 78 of front beam member 22. Stiffening ribs 76 are positioned between side window defrost duct channels 28 and 30 and main air conditioning duct channel 32.

[0021] Steering column support 14 is formed from an upper steering column support member 80 and a lower steering column support member 82. Upper and lower steering support members 80 and 82 are coupled together with, for example, fasteners. Steering column support 14 is coupled to beam structure 12 with, for example, fasteners. Lower steering support member 82 includes a pedal bracket portion 84 for attaching the vehicle accelerator and brake pedals 86 and 88.

[0022] End brackets 18 and 20 attach to opposing ends 90 and 92 of beam structure 12. End brackets 18 and 20 are configured to attach to an automobile body to secure beam structure 12 within a passenger compartment of an automobile.

[0023] The above described instrument panel beam assembly 10 that includes a thermoplastic beam structure 12 having integrally molded-in HVAC ducts and energy absorbers 66 supports the decorative panel(s) of the instrument panel. The integrally molded-in HVAC ducts 42, 44, and 46, and energy absorbers 66 result in fewer parts than known instrument panel structures which provides for simplified instrument panel fabrication and lower fabrication labor costs.

[0024] While the invention has been described in terms of various specific embodiments, those skilled in the art will recognize that the invention can be practiced with modification within the spirit and scope of the claims.

WHAT IS CLAIMED IS:

1. An instrument panel beam assembly (10) comprising:

an elongate front beam member (22) comprising a plurality of duct channels (28,32) and a plurality of energy absorbers (66);

an elongate rear beam member (24) comprising a plurality of duct channels (36, 38, 40) corresponding to said front beam member duct channels, said front beam member coupled to said rear beam member forming a beam structure (12) so that said plurality of corresponding duct channels in said front and rear beam members form a plurality of ducts (42, 44, 46) in said beam structure.

2. An assembly (10) in accordance with Claim 1 further comprising an upper steering column support (80) coupled to said beam structure (12).

3. An assembly (10) in accordance with Claim 2 further comprising a lower steering column support (82) coupled to said upper steering column support (80) and to said beam structure (12).

4. An assembly (10) in accordance with Claim 1 wherein each said energy absorber (66) comprises a substantially D-shape configuration.

5. An assembly (10) in accordance with Claim 1 wherein said front beam member (22) further comprises a C-channel support rod (72) extending between at least two of said energy absorbers (66).

7. An assembly (10) in accordance with Claim 1 further comprising a center stack (16) coupled to said beam structure (12), said center stack is sized to receive automobile system controls.

8. An assembly (10) in accordance with Claim 1 further comprising a first end bracket (18) attached to a first end of said beam structure (12) and a second end bracket (20) attached to a second end of said beam structure.

9. An assembly (10) in accordance with Claim 1 further comprising a defrost plenum member (26) coupled to said rear beam member (24), said defrost plenum member comprising at least one defrost duct channel (54) corresponding to and aligning with at least one defrost duct channel (52) in said rear beam member so that said defrost duct channels of said plenum member and said rear beam member form at least one defrost duct (60).

10. An assembly (10) in accordance with Claim 1 wherein said plurality of ducts in said beam structure comprise a front defrost duct (60), side window defrost ducts (42, 44), and main air conditioning ducts (46), and said front beam member (22) comprises at least one air conditioning duct outlet (48).

11. An assembly (10) in accordance with Claim 1 wherein said front and rear beam members (22, 24) comprise a thermoplastic material.

12. A method of producing an instrument panel beam assembly (10) comprising:

molding an elongate front beam member (22) from a thermoplastic material, the front beam member comprising a plurality of duct channels (28, 32) and a plurality of energy absorbers (66);

molding an elongate rear beam member (24) from a thermoplastic material, the rear beam member comprising a plurality of duct channels (36, 38, 40) corresponding to the front beam member duct channels;

coupling the front beam member to the rear beam member forming a beam structure (12) so that the plurality of corresponding duct channels in the front and rear beam members form a plurality of ducts (42, 44, 46) in the beam structure.

13. A method in accordance with Claim 12 further comprising:

molding a defrost plenum member (26) from a thermoplastic material, the defrost plenum member comprising at least one defrost duct channel (54); and

coupling the defrost plenum member to the rear beam member (24) so that the at least one defrost duct channel of the plenum member aligns with corresponding at least one defrost duct channel in the rear beam member to form at least one defrost duct (60).

14. A method in accordance with Claim 12 further comprising:

forming an upper steering column support (80);

forming a lower steering column support (84);

coupling the upper steering column support member to the lower steering column support member to form a steering column support (14); and

coupling the steering column support to the beam structure (12).

15. A method in accordance with Claim 12 wherein each energy absorber (66) comprises a substantially D-shape configuration.

16. A method in accordance with Claim 12 wherein the front beam member (22) further comprises a C-channel support rod (72) extending between at least two energy absorbers (66).

17. A method in accordance with Claim 12 further comprising:

molding a center stack (16) from a thermoplastic material; and

coupling the center stack to the beam structure (12).

18. A method in accordance with Claim 12 further comprising:

forming a first end bracket (18) and a second end bracket (20);

attaching the first end bracket to a first end of the beam structure; and

attaching the second end bracket to a second end of the beam structure.

19. A method in accordance with Claim 12 wherein coupling the front beam member (22) to the rear beam member (24) comprises coupling the front beam member to the rear beam member with at least one of vibration welding, heat bonding, adhesive bonding, and fasteners.

20. A instrument panel beam assembly (10) comprising:

a thermoplastic front beam member (22) comprising a plurality of molded-in duct channels (28, 32) and a plurality of energy absorbers (66);

a thermoplastic rear beam member (24) comprising a plurality of molded-in duct channels (36, 38, 40) corresponding to said front beam member duct channels, said front beam member coupled to said rear beam member forming a beam structure (12) so that said plurality of corresponding duct channels in said front and rear beam members form a plurality of ducts (42, 44, 46) in said beam structure; and

a thermoplastic defrost plenum member (26) comprising at least one defrost duct channel (54) corresponding to and aligning with at least one defrost duct channel (52) in said rear beam member so that said defrost duct channels of said plenum member and said rear beam member form at least one defrost duct (60), said plenum member coupled to said rear beam member.

21. An assembly (10) in accordance with Claim 20 further comprising a steering column support coupled to said beam structure (12), said steering column support (14) comprising an upper steering column support member (80) and a lower steering column support member (82) coupled to said upper steering column support member.

22. An assembly (10) in accordance with Claim 20 wherein said front beam member (22) further comprises a C-channel support rod (72) extending between at least two of said energy absorbers (66), said C-channel support rod comprising a glove box hinge (74).

23. An assembly (10) in accordance with Claim 20 further comprising a center stack (160 coupled to said beam structure (12), said center stack sized to receive automobile system controls.

24. An assembly (10) in accordance with Claim 20 wherein said front beam member (22) is coupled to said rear beam member (24) by at least one of vibration welding, heat bonding, adhesive bonding, and fasteners.

25. An assembly (10) in accordance with Claim 20 further comprising a center stack (16) integrally molded with said thermoplastic front beam member (22), said center stack sized to receive automobile system controls.

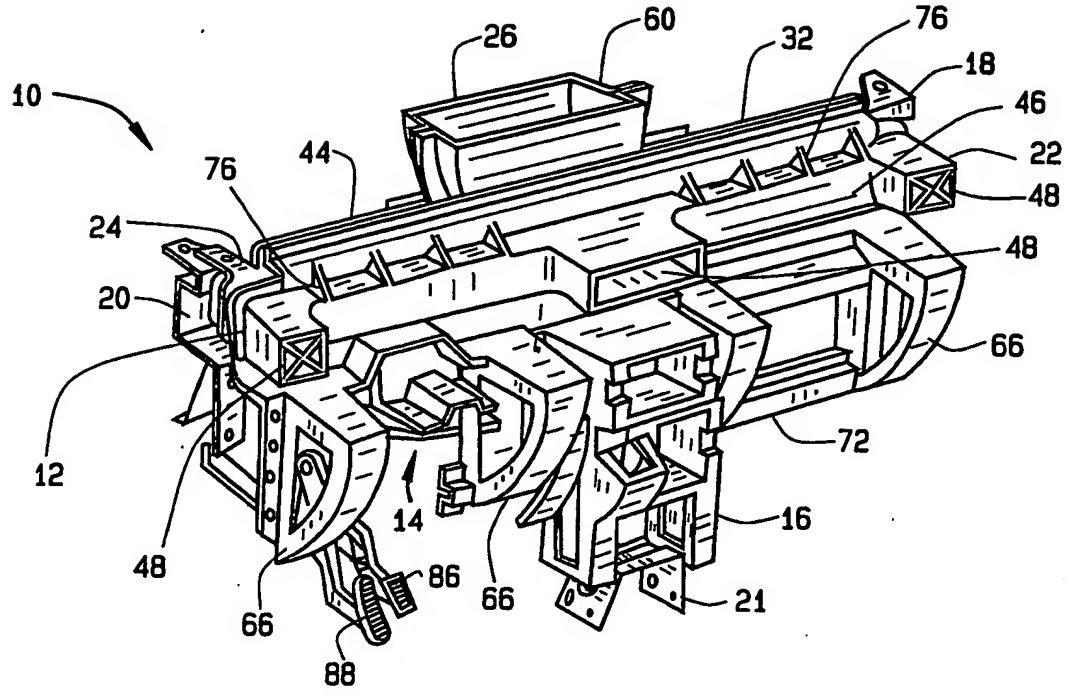
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FIG. 1

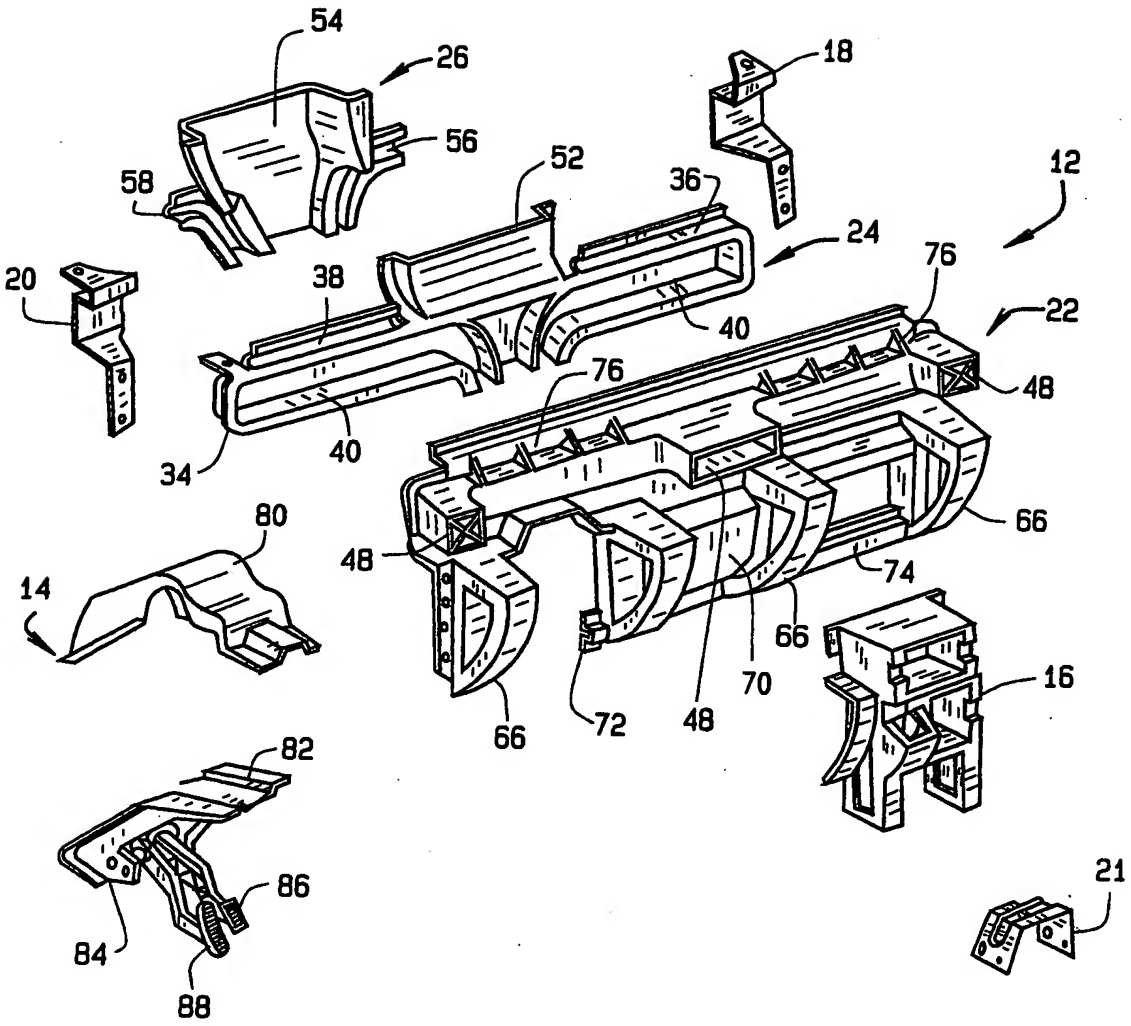
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FIG. 2

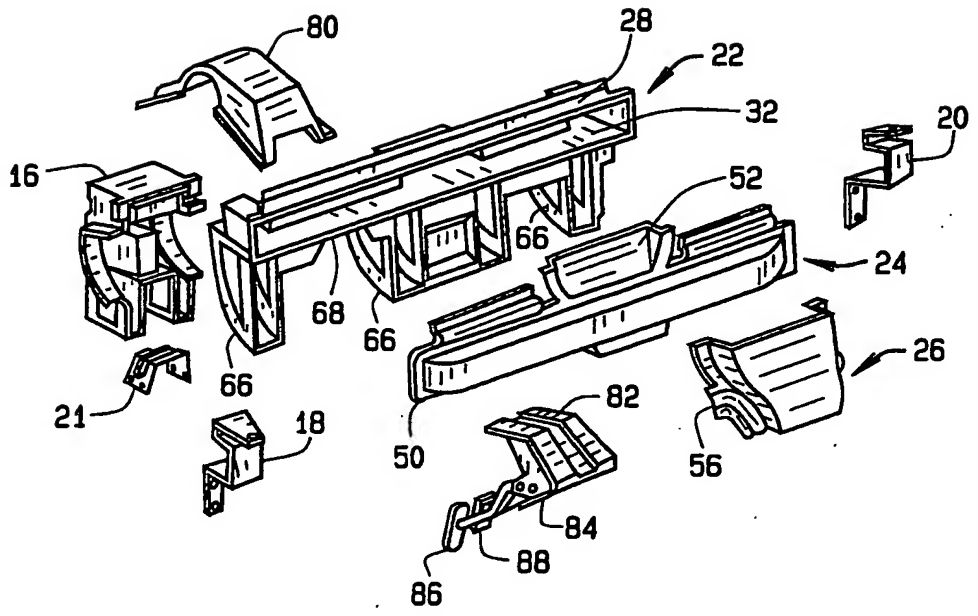

FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.
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A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :B60J 7/00
US CL :296/208

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 296/208, 70, 72, 192; 180/90; 280/779; 454/127

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,311,960 A (KUKAINIS et al.) 17 May 1994 (17.05.1994), Figure 1.	1-24
Y	US 5,312,133 A (PIETILA et al.) 17 May 1994 (17.05.1994), Figure 1.	1-24
Y	US 5,556,153 A (KELMAN et al.) 17 September 1996 (17.09.1996), Figure 1.	1-24
Y	US 5,564,515 A (SCHAMBRE) 15 October 1996 (15.10.1996), Figure 3.	1-24
Y	US 5,676,216 A (PALMA et al.) 14 October 1997 (15.10.1997), Figure 1.	1-24
Y	US 5,762,395 A (MERRIFIELD et al.) 09 June 1998 (09.06. 1998), Figure 1.	1-24

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US02/04785

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,934,744 A (JERGENS et al.) 10 August 1999 (10.08.1999), Figure 1.	1-24
Y	US 6,095,272 A (TAKIGUCHI et al.) 01 August 2000 (01.08.2000), Figure 10.	1-24
Y	US 6,110,037 A (YOSHINAKA) 29 August 2000 (29.08.2000), Figure 2.	1-24
Y	US 6,237,956 A (HABA et al.) 29 May 2001 (29.05.2001), Figure 1.	1-24
Y, E	US 6,371,551 B1 (HEDDERLY) 16 April 2002 (16.04.2002), Figure 1.	1-24
Y, E	US 6,378,934 B1 (PALAZZOLO et al.) 30 April 2002 (30.04.2002), Figure 5.	1-24